

WHAT IS CLAIMED IS:

1. A data alteration checking apparatus for discriminating whether data recorded on a recording medium has been altered or not, comprising:

5 reading means for respectively reading out a data block and a file from said recording medium on which with respect to one or each of a plurality of files belonging to a directory serving as an upper concept in which one or a plurality of files are bound, the data block including
10 one or a plurality of list-type data structures each including a plurality of first arithmetic operation values which were arithmetically operated every said file on the basis of attribute information of the file by a predetermined arithmetic operating method which is unconditional and does not have a reversible property based on a reverse arithmetic operation has been recorded into an area that is not accessed
15 by a file system on said recording medium and each of said first arithmetic operation values has been written into the corresponding file; and

20 comparing means for comparing a second arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method on the basis of the attribute information of said file read out by said reading means with said first arithmetic operation value
25 which corresponds to said file and is included in said list-type data structure corresponding to said directory to which said file read out by said reading means belongs

in said data block read out by said reading means,

wherein on the basis of a result of the comparison by said comparing means, when said first and second arithmetic operation values do not coincide, it is determined that said file has been altered.

2. An apparatus according to claim 1, wherein a third arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method by using said first arithmetic operation values of all of said files belonging to said directory with respect to each of said directories included in said list-type data structure is further included in said list-type data structure recorded on said recording medium, and

a fourth arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method by using said third arithmetic operation values of all of said list-type data structure included in said data block is included in said data block recorded on said recording medium.

3. An apparatus according to claim 2, wherein when said file is read out from said recording medium by said reading means, said third arithmetic operation value of said list-type data structure which corresponds to said directory serving as a target and is included in said data block read out by said reading means is compared with a fifth arithmetic operation value which was

arithmetically operated by said predetermined arithmetic operating method by using said first arithmetic operation values of all of said files belonging to said directory serving as said target, and

5 as a result of said comparison, if said third and fifth arithmetic operation values do not coincide, it is determined that said directory has been altered.

4. An apparatus according to claim 1, wherein said files are bound in said directory in accordance with a kind
10 of said file.

5. An apparatus according to claim 4, wherein when the kind of said file indicates the file which does not need the data alteration check, said data alteration check for said directory to which the kind of said file corresponds
15 is not performed.

6. An apparatus according to claim 4, wherein the kind of said file is based on contents of the data which is stored into said file.

7. An apparatus according to claim 4, wherein the
20 kind of said file is based on the presence or absence of a protection to said file.

8. An apparatus according to claim 1, further comprising recording means for recording the data onto the recording medium, and

25 wherein said data block has a field in which the number of updating times of said data block or a value showing that said data block is invalid is stored, and

5 said recording means is constructed in a manner
such that said data block is written twice into the area
which is not accessed by said file system, when said data
block is rewritten, a value of said field of one of said
twice-written data blocks is set to the value showing that
said data block is invalid, said one data block is rewritten,
when said rewriting is finished, the value of said field
of said one data block is set to a value indicative of the
number of updating times of said one data block, a value
10 of said field of the other one of said twice-written data
blocks is set to the value showing that said data block is
invalid, said other data block is rewritten, and when said
rewriting is finished, the value of said field of said other
data block is set to a value indicative of the number of
updating times of said other data block.

15 9. An apparatus according to claim 1, wherein said
first arithmetic operation values are arranged in the
searching order of a tree structure in which the
corresponding file is constructed by the file system and
are stored into said list-type data structure.

20 10. A data alteration checking method of
discriminating whether data recorded on a recording medium
has been altered or not, comprising:

25 a reading step of respectively reading out a data
block and a file from said recording medium on which with
respect to one or each of a plurality of files belonging
to a directory serving as an upper concept in which one or

5 a plurality of files are bound, the data block including
one or a plurality of list-type data structures each
including a plurality of first arithmetic operation values
which were arithmetically operated every file on the basis
of attribute information of said file by a predetermined
arithmetic operating method which is unconditional and does
not have a reversible property based on a reverse arithmetic
operation has been recorded into an area that is not accessed
by a file system on said recording medium and each of said
10 first arithmetic operation values has been written into the
corresponding file; and

15 a comparing step of comparing a second arithmetic
operation value which was arithmetically operated by said
predetermined arithmetic operating method on the basis of
said attribute information of said file read out by said
reading step with said first arithmetic operation value which
corresponds to said file and is included in said list-type
data structure corresponding to said directory to which said
file read out by said reading step belongs in said data block
read out by said reading step,

20 wherein on the basis of a result of the comparison
by said comparing step, when said first and second arithmetic
operation values do not coincide, it is determined that said
file has been altered.

25 11. A recording medium on which data is recorded by
a file structure having a directory serving as an upper
concept in which one or a plurality of files are bound,

wherein with respect to one or each of said plurality of files belonging to said directory serving as an upper concept in which one or a plurality of said files are bound, a data block including one or a plurality of list-type data structures each including a plurality of first arithmetic operation values which were arithmetically operated every file on the basis of attribute information of said file by a predetermined arithmetic operating method which is unconditional and does not have a reversible property based on a reverse arithmetic operation is recorded into an area that is not accessed by a file system and each of said first arithmetic operation values is written into the corresponding file.

12. A medium according to claim 11, wherein

a second arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method by using said first arithmetic operation values of all of said files belonging to said directory with respect to each of said directories included in said list-type data structure is further included in said list-type data structure, and

a third arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method by using said second arithmetic operation values of all of said list-type data structure included in said data block is included in said data block.

13. A medium according to claim 11, wherein said files

are bound in said directory in accordance with a kind of said file.

14. A medium according to claim 13, wherein the kind of said file is based on contents of the data which is stored into said file.

15. A medium according to claim 13, wherein the kind of said file is based on the presence or absence of a protection to said file.

16. A medium according to claim 11, wherein said data block is written twice into the area which is not accessed by said file system and has a field in which the number of updating times of said data block or a value showing that said data block is invalid is stored, and

when said data block is rewritten, a value of said field of one of said twice-written data blocks is set to the value showing that said data block is invalid, said one data block is rewritten, when said rewriting is finished, the value of said field of said one data block is set to a value indicative of the number of updating times of said one data block, a value of said field of the other one of said twice-written data blocks is set to the value showing that said data block is invalid, said other data block is rewritten, and when said rewriting is finished, the value of said field of said other data block is set to a value indicative of the number of updating times of said other data block.

17. A medium according to claim 11, wherein a size of said data block is set to a variable length in accordance with the number of said directories existing on the recording medium on which said data block is recorded.

5 18. A medium according to claim 11, wherein said list-type data structure is set to a variable length in accordance with the number of said files belonging to said directory to which said list-type data structure corresponds.

10 19. A medium according to claim 11, wherein said first arithmetic operation values are arranged in the searching order of a tree structure in which the corresponding file is constructed by the file system and are stored into said list-type data structure.

15 20. A data alteration checking apparatus for discriminating whether data recorded on a recording medium has been altered or not, comprising:

reproducing means for reproducing said recording medium on which unique identification information is fixedly
20 recorded every recording medium, and with respect to one or each of a plurality of files recorded on said recording medium, a first arithmetic operation value which was arithmetically operated on the basis of attribute information of said file and said identification information
25 by a predetermined arithmetic operating method which is unconditional and does not have a reversible property based on a reverse arithmetic operation has been stored; and

comparing means for comparing said first
arithmetic operation value stored in said file reproduced
by said reproducing means with a second arithmetic operation
value which was arithmetically operated by said
5 predetermined arithmetic operating method on the basis of
said attribute information of said file reproduced by said
reproducing means and said identification information,

wherein on the basis of a result of the comparison
by said comparing means, when said first and second
10 arithmetic operation values do not coincide, it is determined
that said file is illegal.

21. An apparatus according to claim 20, wherein
on said recording medium, a list-type data
structure in which said first arithmetic operation values
of every one or a plurality of said files recorded on said
15 recording medium have been stored is recorded into an area
which is not accessed by a file system of said recording
medium, and

when said file recorded on said recording medium
20 is reproduced by said reproducing means, said first
arithmetic operation value stored in said list-type data
structure is compared with said second arithmetic operation
value which was arithmetically operated by said
predetermined arithmetic operating method on the basis of
25 said attribute information of said file reproduced by said
reproducing means and said identification information, and
when said first and second arithmetic operation values do

not coincide, it is determined that said file is illegal.

22. An apparatus according to claim 20, wherein said identification information is ID information which was uniquely determined every said recording medium.

5 23. An apparatus according to claim 20, wherein said identification information is information indicative of physical defect information of said recording medium.

24. An apparatus according to claim 20, wherein said identification information comprises both of ID information which was uniquely determined every said recording medium and physical defect information of said recording medium.

25. An apparatus according to claim 20, wherein said attribute information is copyright information of said file.

10 26. An apparatus according to claim 20, wherein said attribute information is present state value information of said file.

15 27. A data alteration checking method of discriminating whether data recorded on a recording medium has been altered or not, comprising:

20 a reproducing step of reproducing said recording medium on which unique identification information is fixedly recorded every recording medium, and with respect to one or each of a plurality of files recorded on said recording medium, a first arithmetic operation value which was
25 arithmetically operated on the basis of attribute information of said file and said identification information by a predetermined arithmetic operating method which is

unconditional and does not have a reversible property based on a reverse arithmetic operation has been stored; and

5 a comparing step of comparing said first arithmetic operation value stored in said file reproduced by said reproducing step with a second arithmetic operation value which was arithmetically operated by said predetermined arithmetic operating method on the basis of said attribute information of said file reproduced by said reproducing step and said identification information,

10 wherein on the basis of a result of the comparison by said comparing step, when said first and second arithmetic operation values do not coincide, it is determined that said file is illegal.

28. A recording medium onto/from which data can be recorded and/or reproduced, wherein

15 unique identification information is fixedly recorded every medium, and one or a plurality of said files in each of which a first arithmetic operation value which was arithmetically operated on the basis of attribute information of said file and said identification information by a predetermined arithmetic operating method which is unconditional and does not have a reversible property based on a reverse arithmetic operation has been stored are recorded.

20 29. A medium according to claim 28, wherein a list-type data structure in which said first arithmetic operation value of one or each of a plurality of said recorded files has

been stored is recorded into an area which is not accessed by a file system.

30. A medium according to claim 28, wherein said identification information is ID information which was uniquely determined every said medium.

31. A medium according to claim 28, wherein said identification information is information indicative of physical defect information of said medium.

32. A medium according to claim 28, wherein said identification information comprises both of ID information which was uniquely determined every said medium and physical defect information of said medium.

33. A medium according to claim 28, wherein said attribute information is copyright information of said file.

34. A medium according to claim 28, wherein said attribute information is present state value information of said file.